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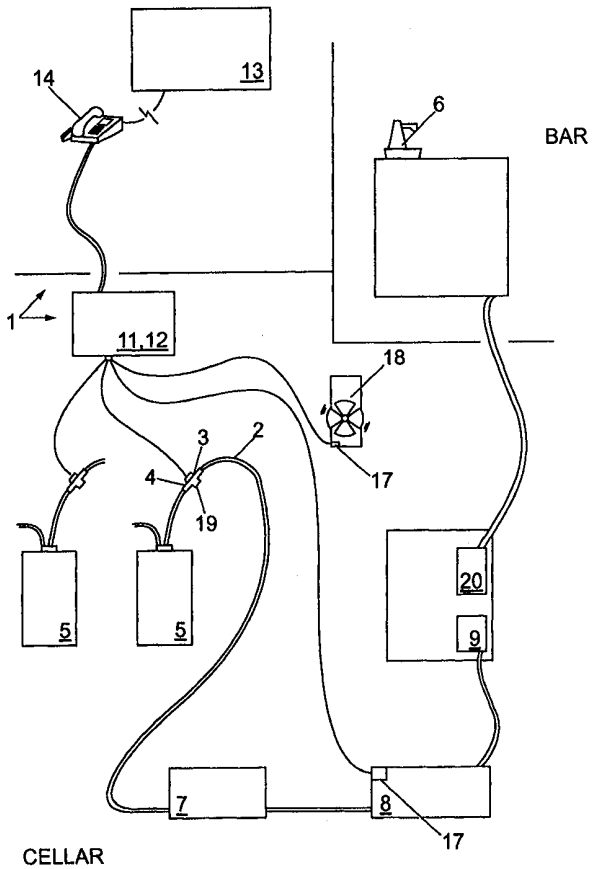
(54) Title: SYSTEM AND METHOD FOR MONITORING FLUID FLOW

(57) Abstract

System for monitoring flow of a fluid in at least one conduit comprising monitoring means for monitoring data relating to the volume flow of the fluid over a given period of time from data derived from a flow measurement means for measuring the total volume flow in the conduit at any given time; methods use and kit of parts therefor.



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SYSTEM AND METHOD FOR MONITORING FLUID FLOW

The present invention relates to a system and method for monitoring flow of fluid in at least one conduit, and a kit of parts forming the system. The system and method have applications in many industrial sectors and in particular where different fluids may be carried by the same conduits at different times.

For example, in many applications, cleaning fluid of some type is periodically passed through conduits which usually carry desired fluids such as food or drink products, oil, gas, petroleum or any other fluids to effect periodic cleaning and prevent contamination or other effect on the conduit.

Applications may also be envisaged where a single conduit may be used for several fluids consecutively whether or not a cleaning step is provided between these fluids, or where a conduit carries one fluid only.

In particular the present invention has applications in breweries and in flow systems between the cellars and public areas of public houses, cafes, restaurants, bars and the like serving beer, soft drinks and wine and the like on draught.

When using fluid conduit systems it is often important to determine how much fluid flows through the conduit at any given time. This information is particularly useful in management of fluid flow in a plurality of conduits.

Present systems have been unable to reliably monitor fluid flow automatically and accurately.

Even present systems which do allow some form of flow measurement within a conduit do not identify the fluid, so that flow of different fluids within the same conduit such as water, cleaning fluid and the product to be dispensed cannot be distinguished.

In systems where several liquids are consecutively passed through the same conduit, it is also important to determine how much of each fluid flows through the conduit at any given time. This information is valuable in several applications, such as providing data for sales analysis of various liquids, analysis of use of these liquids or frequency of cleaning of the conduits or correlation with data otherwise provided of liquid dispensed.

It is an object of the present invention to reliably monitor fluid flow automatically and accurately.

It is a further object of the present invention to provide a fluid flow monitoring system which allows measurement of flow of different fluids within the same conduit.

It is a further object of the present invention to provide a fluid flow monitoring system to monitor fluid flow in conduits at a plurality of locations which may be centrally managed by the system user.

In its broadest aspect there is provided according to the present invention a system for monitoring flow of a fluid in at least one conduit comprising monitoring means for monitoring data relating to the volume flow of the fluid over a given period of time from data derived from a flow measurement means for measuring the total volume flow in the conduit at any given time.

The present invention is based on the surprising discovery that a system may be provided to monitor fluid flow which uses flow data over a given time to give the user an accurate representation of fluid flow within the conduit in that time.

Reference herein to a conduit is to any pipe, channel, hose or any other pathway through which a fluid may flow.

Reference herein to a fluid is to any flowable solid, liquid, gas or vapour including water, detergent, food and drink products, oil, gas, air and also including fluids as dissolved or mixed solids or gases or mixtures thereof.

Reference herein to a flow measurement means is to any commonly used flow meter such as turbine meters including infra red or Hall effect sensors or sensors using any other working principle.

Reference herein to a given period of time can be any period of time suitable for the intended application, for example from one second to one month.

In a system as hereinbefore defined, the monitoring means may comprise any means to effectively monitor flow of fluid in at least one conduit as hereinbefore defined. For example monitoring means may comprise any means to collect store and process the data, displaying it to the user in suitable fashion. Preferably monitoring means comprises calculating means, storage means, processing means and display means.

Preferably, monitoring means also monitors data derived from an identification device for identifying the fluid in the conduit at any given time.

The device for identification of a fluid in a conduit may be any known device for this purpose. The device may function by measuring any fluid property which allows differentiation between the different fluids conducted through the conduit, for example, viscosity, density, light or sound or other electromagnetic radiation transmission or impedance. Preferably the device measures an electrical property of the fluid such as impedance or capacitance.

In a device where an electrical property is measured, a device temperature sensor may also be provided to compensate for variations in the electrical property caused by fluctuations in temperature.

Reference is made to the device described in co-pending UK application "Device and Method for Identification of a Fluid in a Conduit" by the same applicant which is hereby incorporated herein by reference.

Connection means may be provided for operative communication between the system and the identifying device and measuring means. For example, the connection means may be in the form of radio or IR, modem, electrical cable, optical fibre or any other connection means suitable for operative communication. Preferably, connection means is in the form of electrical cables.

A system as hereinbefore defined may monitor flow of a fluid in one or more conduit. Preferably, a system as hereinbefore defined comprises monitoring means to monitor data relating to the flow of the fluids in a plurality of conduits, each conduit provided with an identification device and flow measurement means.

For example, each of a plurality of conduits may carry a range of fluids which overlaps with the range of fluids in other conduits and the monitoring means may separately monitor flow of a certain fluid in each conduit in which it is present.

The monitoring means may monitor data from a single location having a plurality of conduits or from a plurality of separate remote conduit locations.

Preferably the monitoring means monitors data from a plurality of separate remote conduit locations, each comprising a plurality of conduits.

Reference herein to a remote locations is to a spatial distance between the locations such that dedicated electrical cables between two locations would not usually be provided. For example a remote location includes a location which is housed within the same large building as another location or different building, town, city or country.

The system capacity for monitoring a plurality of remote conduit locations is particularly advantageous where several locations, each having a plurality of conduits must be all managed by the same system user. The invention allows simple monitoring of data from a variety of locations and thus simple comparison of performance and working parameters in those locations.

Any distribution of system functions between the system components may be envisaged which allows economic construction and ease of use and control. For example, the calculating means, storage means, processing means and display means may all be associated with the conduit or conduits. This is advantageous where a simple system is required at a single location. Preferably this form of local system is hand held, in the form of a pen, wand,

magic eye or like device which monitors simple and limited fashion data, and displays for an example as a coded system of lights or like display, eg colour coded, in particular to indicate presence or absence of contamination or quality.

Preferably, central display and processing means and optionally calculating means are situated at mobile or fixed system user location remote from the conduit location or locations and connected to data storage means by a data link.

This system distribution is cost effective and practical where several locations are all managed by the same system user and central display and processing means and optionally calculating means may be situated in a location which is convenient to the manager rather than local to the location or locations of the conduits.

In this system distribution with a plurality of conduit locations, the system user location may be at one of the conduit locations or remote from all the conduit locations.

The location of the data storage means and calculating means may be any which is convenient to the system user. The user may wish for as little monitoring equipment as possible at the conduit location or locations, in which case the data storage and calculating means may be situated at the system user location with the central display and processing means.

Preferably, where the display and processing means are provided centrally at the system user location, data storage means and optionally calculating means are situated at the conduit locations.

This system distribution allows a simple division of the system tasks into local calculating and storage and central display and processing. Data relating to a single location is held at that location for downloading over a data link and processing.

Any data link may be provided which is suitable for the system as hereinbefore described. For example, the link may be by IR, radio transmission or optical fibre or by a modem link. Preferably, the data link is a modem link. Modems are an economic means for data transfer, requiring no installation of extra wiring or devices other than a standard modem and also allow a mobile system user location.

Any number of data storage means and data calculating means may be provided for a plurality of conduits. In a preferred construction, each conduit is provided with data storage means and optionally data calculating means. In this way both the data storage means and data calculating means may be dedicated to a single conduit allowing a simple and transparent system set up.

In another construction a single data storage means and optionally a data calculating means may be provided for a plurality of conduits at a conduit location. This can be advantageous in memory management and provides an option for possible time sharing of the calculating means between the conduits.

Any array of memory banks may be provided which allows efficient data storage and retrieval. Preferably data storage means for each conduit allocates a plurality of memory banks. A plurality of memory banks may be used to store information about fluid flow in a variety of different ways. For example

data may be allocated according to time segments or according to fluid type, as been identified by the fluid identification device.

Preferably, the data calculating means stores the measured volume flow in a memory bank associated with a given conduit and a given fluid type identified. In this arrangement each memory bank for each conduit holds volume flow data for a given fluid in that conduit. Volume flow of other fluids is held in other memory banks for the same conduit.

The data may be continuously or non-continuously downloaded from the storage means to the processing and display means by down loading means. Continuous downloading is suitable for applications where a constant update of the fluid flow data is necessary, such as for process control.

Preferably the system as hereinbefore defined comprises automatic downloading means to automatically download the data from the storage means to the processing and display means at pre-set time intervals. This discontinuous downloading is suitable for applications where updates are required less frequently. This is the case for stock control, accounting and other user functions.

The downloading means may be a direct link from the or each storage means to the processing and display means of, a plurality of storage means of a conduit location may be connected together, with a single link to the processing and display means, for example in a daisy chain arrangement. This latter arrangement has the advantage of one simple communications link between each conduit location having a plurality of storage means and the system user location.

The pre-set time intervals may be hourly, daily, weekly, monthly or even yearly as required.

Automatic downloading means may be controlled by any suitable means. Preferably automatic downloading means are controlled by the processing means. In this way, the system user can change downloading frequency where required from the processing means at the system user location.

The system as hereinbefore defined may comprise activation means to activate and de-activate the identification device, flow measurement means and other system components. Preferably, activation means are provided such that monitoring is activated responsive to a movement of fluid in a conduit.

Preferably activation means are provided such that monitoring is deactivated responsive to lack of movement of fluid in the conduit.

In this way monitoring is operative solely when the conduit is in use. The activation means may advantageously be adapted to monitor signals from the flow measurement means to fulfil the above described function.

A system as hereinbefore described may monitor additional data which is also useful for management of conduit locations. For example, many fluids conducted by conduits are required to be kept at or dispensed at a certain temperature. Equipment provided to fulfil this purpose can be expensive and condition monitoring of the equipment is therefore recommended to anticipate breakdown of the equipment and so avoid the costs associated with such breakdown.

Preferably, a system as hereinbefore defined for monitoring flow of a cold fluid comprises a condition monitoring system for cooling equipment adapted to cool fluid in the conduit or cool air temperature around the conduit, the condition monitoring system comprising condition monitoring sensors adapted to monitor the current drawn by and/or the duty cycle of the equipment, and condition monitoring means to generate a condition value which is stored in data storage means and displayed and processed at the display and processing means.

The condition values can then be monitored using the system of the present invention, to give the system user more valuable information.

The condition monitoring system may be distributed within the fluid flow monitoring system and condition monitoring sensors may be incorporated anywhere where the current drawn by and/or duty cycle of the equipment may be monitored. Preferably condition-monitoring sensors are incorporated into the connection between the equipment and the electricity supply. This provides an accessible position for the condition monitoring sensors with a reliable indication as to the duty cycle and current drawn.

More preferably, condition-monitoring sensors are incorporated into a standard electricity supply socket. In this way the condition monitoring system may be fitted without any adaptation to the cooling equipment.

Alternatively, or additionally the performance of the cooling equipment may be monitored by result. Preferably, in a fluid flow monitoring system as hereinbefore defined, temperature monitoring means are provided for monitoring ambient temperature at the conduit location wherein the ambient

temperature values are stored in data storage means and displayed and processed at the display and processing means.

Preferably a fluid flow monitoring system as hereinbefore defined comprises temperature monitoring means for monitoring temperature of the fluid in the conduit after cooling and immediately before exit from the conduit, wherein the fluid temperature values are stored in data storage means and displayed and processed at the display and processing means.

According to these preferred embodiments, the monitoring means may also monitor any cooling parameters including the current drawn by or duty cycle of cooling equipment cooling fluid in the conduit or cooling equipment cooling air temperature around the conduit, temperature of the fluid in the conduit after cooling and ambient temperature at the conduit location. This data may be processed and displayed.

Preferably the system as hereinbefore defined comprises warning means for producing a warning when the monitored values fall outside a pre-set range. The warning may be in the form of a screen display, alarm or a visual or auditory or any other conventional warning.

The system as hereinbefore defined may also comprise means for producing a warning when the fluid flow monitored falls outside a pre-set range, or when flow of a certain fluid is detected. Such information is useful for determination of leaks, warnings of future low or high stock level or identification of faults in line hygiene due to infrequent or insufficient cleaning. Warning means at any point of the system may produce the warning.

Preferably, a system as hereinbefore defined comprises warning means at a conduit location for producing a warning when the fluid flow monitored falls outside a pre-set range or when flow of a certain fluid is detected. This information is often of more value to the individual manager of a conduit location than the system user.

In a further aspect the present invention provides a method for monitoring flow of a fluid in at least one conduit using a system as hereinbefore defined.

The method corresponds to the system as hereinbefore defined and corresponding method steps have the same advantages as those described for the corresponding device features.

In a further aspect of the present invention there is provided the use of a system and/or method as hereinbefore defined for monitoring dispensing characteristics of fluids from a plurality of fonts in a plurality of locations such as public houses, bars or cafés.

In a further aspect of the present invention there is provided a kit of parts forming the system as hereinbefore defined.

The system of the present invention has many varied applications in monitoring of fluid in a conduit. It provides a valuable data source for the user whether they are managing a plurality of conduit locations or a single location.

The invention is now illustrated in non-limiting manner with reference to Figures 1 – 7.

Figure 1 is a scheme of the present invention showing the system components in use at a conduit location such as public house, café or bar with links to system components at a system user location.

Figure 2 is a scheme showing the system distribution where a plurality of conduit locations and a system user location with central display and processing means are provided.

Figure 3 is a scheme showing communication links between a plurality of data storage means and the system user location.

Figure 4 shows the scheme of Figure 4 in an alternative embodiment.

Figure 5 is a flow diagram of the functioning of the present invention.

Figure 6 is a table showing a typical print out from the system according to the present invention.

Figure 7 is a table showing a further typical print out from the system according to the present invention.

In Figure 1 is shown a preferred embodiment of the system of the present invention in location in, for example, a public house. In this preferred embodiment, the system (1) monitors data from a plurality of conduit locations, that is, from a number of different public houses. Each public house comprises one conduit location with a plurality of conduits.

Each conduit (2) is provided with a flow meter (3) and an identification device (4) for identifying the fluid in the conduit at any given time. The flow meter and identification device may be located within the same housing.

The fluid flow from the keg (5) to font (6) is as follows. The fluid in keg (5) is pressurised by gas to about 8 – 10 psi. Conduit (2) is permanently full of liquid which, when font (6) is activated, runs through pump (7) and ice block (8) towards the font. Some conduits dispense fluid in metered quantities, usually of half a pint, through plenum chamber (9) and a solenoid activated valve (10). Other conduits are not metered and the quantity dispensed is determined directly by the font operator.

Data storage means (11) and data calculating means (12) are provided at the conduit location and information is downloaded from the conduit location to central display and processing means (13), which is provided in a PC via modem link (14).

Figure 1 also shows the condition monitoring system which can form part of the present invention. Condition monitoring sensors (17) are associated with ice block (8) and fan (18). The condition values corresponding to the duty cycle and current drawn of the ice block (8) and fan (18) are stored in data storage means (11) and displayed and processed at the display and processing means (13).

In Figure 2 is shown the system distribution of the preferred embodiment. Most of the system components are situated at each conduit location (15) which is a public house, café etc. except for central display and processing means (13) which is linked to each location by modem link (14) and situated in a location convenient to the system user. The data storage means (11) and data calculating means (12) are in the form of a micro controller with an external address bus provided with a plurality of buffers, each having a plurality of inputs.

Figures 3 and 4 are schemes which illustrate links between a plurality of data storage and data calculating means (12) and central display and processing means (13).

In Figure 3 the scheme shows the aforementioned components and additionally, device temperature sensor (19). Each data storage means (11) associated with an individual conduit is linked by a modem link (14) to the central display and processing means (13) of the system user location. Each data storage means may be at the same or differing conduit location.

In Figure 4 the data storage means (11) are linked together in a daisy-chain arrangement with a modern link (14) between the daisy chain and the central display and processing means (13).

Figure 5 shows information flow from a single conduit (2) to the central display and processing means (13). Fluid movement is sensed by flowmeter (3), which activates the system (1). Data calculating means in the form of micro controller (12) uses the identification of the fluid from identification device (4) to select which memory bank (16) of data storage means (11) will hold the data.

Each memory bank is dedicated to a given fluid which might be identified in the conduit (2) in question. For example, there may be four memory banks active for the conduit, one for the brand of beer in the keg to which the conduit is connected, one for cleaning fluid, one for water and one for air/gas. This last memory bank detects an empty or emptying conduit and may produce a warning at the conduit location to change the keg.

Each conduit is provided with an array of memory banks for storage of fluid flow data for each fluid which may be present in it.

The data storage means (11) is automatically downloaded to the central display and processing means (13) at weekly intervals via a modem link.

The printouts shown in Figures 6 and 7 demonstrate the capabilities of the system.

Figure 6 shows a volume audit report. The conduit location is shown at "site". The volume audit report line frame has been set at 7 days and the volumes monitored by the system are displayed in the table.

The table shown in Figure 7 is a graphical representation of the data shown in Figure 6 obtainable with the system.

REFERENCE NUMERALS

1. System for Monitoring Flow of a Fluid.
2. Conduit.
3. Flow Meter.
4. Identification Device.
5. Keg.
6. Font.
7. Pump.
8. Ice Block.
9. Plenum Chamber.
10. Valve.
11. Data Storage Means.
12. Data Calculating Means.
13. Central Display and Processing Means.
14. Modem Link.
15. Conduit Location
16. Memory Bank
17. Condition Monitoring Sensor
18. Fan
19. Device Temperature Sensor

CLAIMS

1. System for monitoring flow of a fluid in at least one conduit comprising monitoring means for monitoring data relating to the volume flow of the fluid over a given period of time from data derived from a flow measurement means for measuring the total volume flow in the conduit at any given time.

2. System as claimed in Claim 1 wherein a fluid is flowable solid, liquid, gas or vapour selected from water, detergent, food and drink products, oil, gas, air and dissolved or mixed solids, gases or mixtures thereof.

3. System as claimed in any of Claims 1 and 2 wherein flow measurements means is a turbine flow meter including sensors.

4. System as claimed in any one of Claims 1-3 wherein monitoring means comprises calculating means, storage means, processing means and display means.

5. System as claimed in any one of Claims 1-4 wherein monitoring means also monitors data derived from an identification device for identifying fluid in the conduit at any given time.

6. System as claimed in Claim 5 wherein an identification device measures an electrical property of the fluid selected from impedance and capacitance.

7. System as claimed in any one of Claims 1-6 which comprises a

monitoring means to monitor data relating to the flow of the fluids in a plurality of conduits, each conduit provided with an identification device and flow measurement means.

8. System as claimed in any of Claims 1-7 wherein the monitoring means Monitor data from a plurality of separate remote conduit locations, each comprising a plurality of conduits.

9. System as claimed in any of Claim 1-8 wherein central display processing means and optionally calculating means are situated at mobile or fixed system user location remote from the conduit location or locations and connected to data storage means by a data link.

10. System as claimed in Claims 1-9 wherein the display and processing means are provided centrally at the system user location, and data storage means and optionally calculating means are situated at the conduit locations.

11. System as claimed in Claim 10 wherein data relating to a single location is held at that location for downloading over a data link and processing.

12. System as claimed in any of Claims 1-11 wherein each conduit is provide with data storage means and optionally data calculating means.

13. System as claimed in any of Claims 1-12 wherein a single data storage means and optionally a data calculating means is provided for plurality of conduits at a single conduit location.

14. System as claimed in any of Claims 1-13 wherein data calculating

means stores the measured volume flow in a memory bank associated with a given conduit and a given fluid type identified.

15. The system as claimed in any of Claims 1-14 wherein data is downloaded from storage means to the processing and display means by down loading means at preset intervals or as required.

16. System as claimed in any of Claims 1-15 comprising activation means to activate and deactive the identification device, flow measurement means and other system components.

17. System as claimed in any of Claims 1-16 for monitoring flow of a cold fluid comprising the condition monitoring system for cooling equipment adapted to data storage means and displayed and processed at the display and processing means.

18. System as claimed in any of Claims 1-17 which comprises warning means for producing a warning when the monitored values fall outside a pre-set range.

19. Method for monitoring flow of a fluid in at least one conduit using a system as claimed in any one of Claims 1-18.

20. Use of a system as claimed in any one of Claims 1-18 for monitoring dispensing characteristics of fluids from a plurality of fonts in a plurality of locations.

21. Kit of parts forming system as claimed in any one of Claims 1-18.

22. System or method substantially as herein described and in the description or illustrated in the figures.

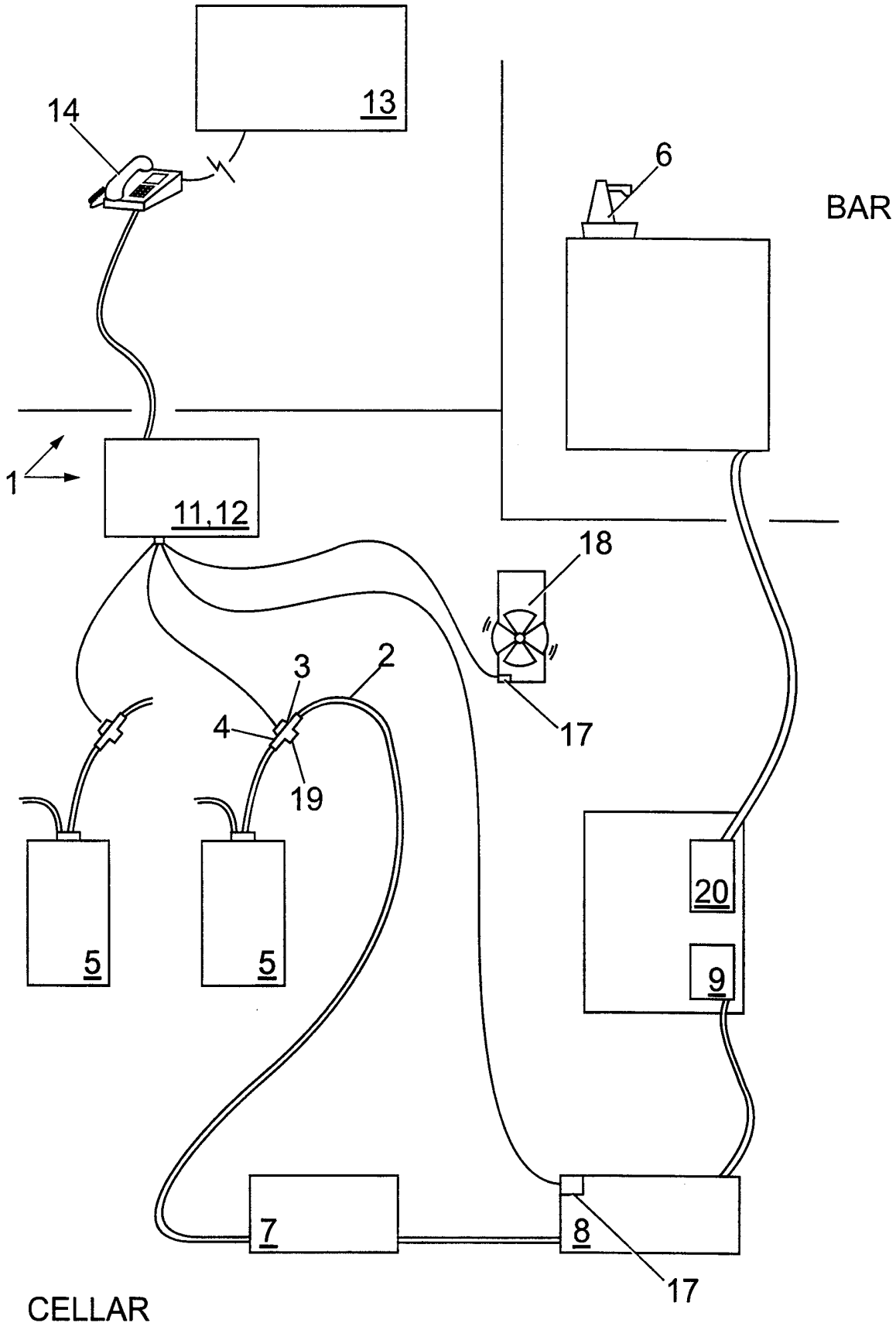


Fig. 1

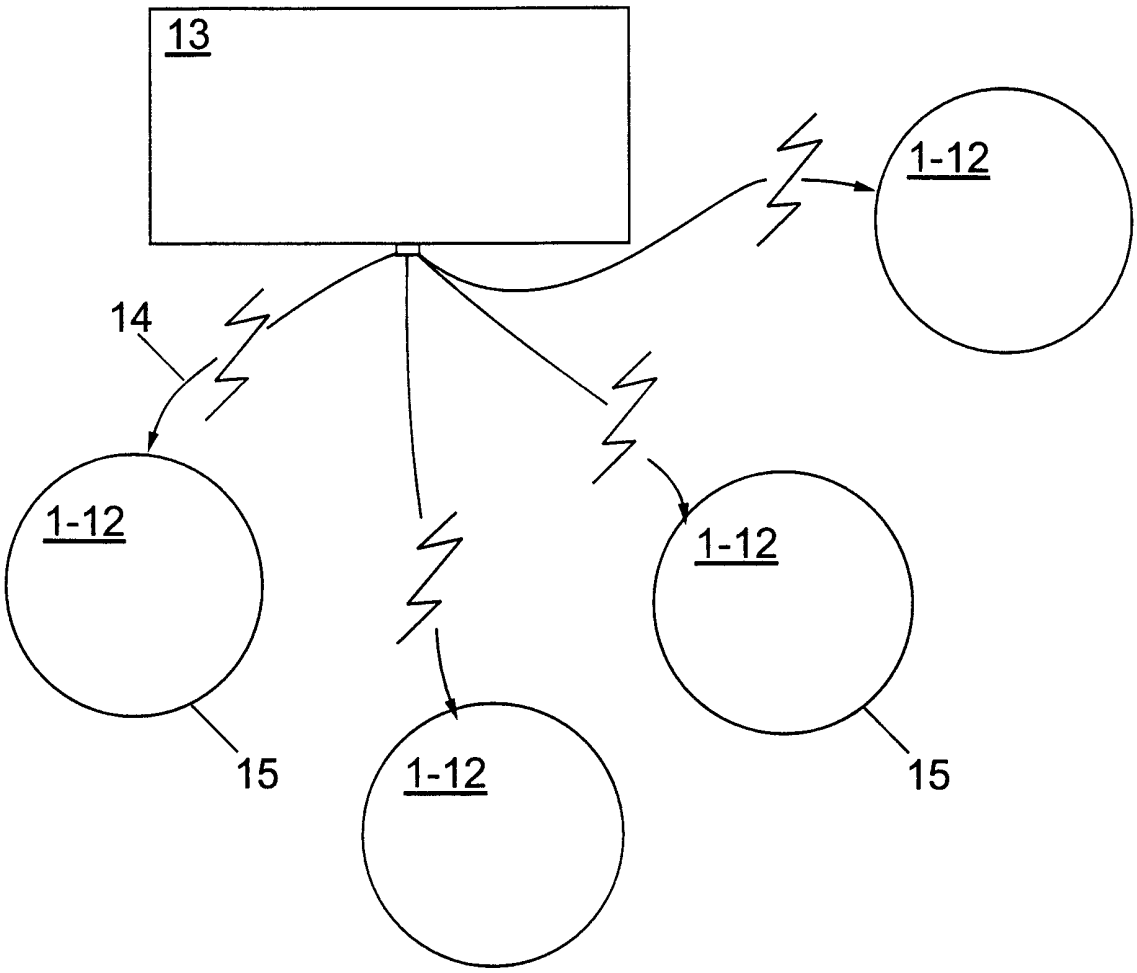
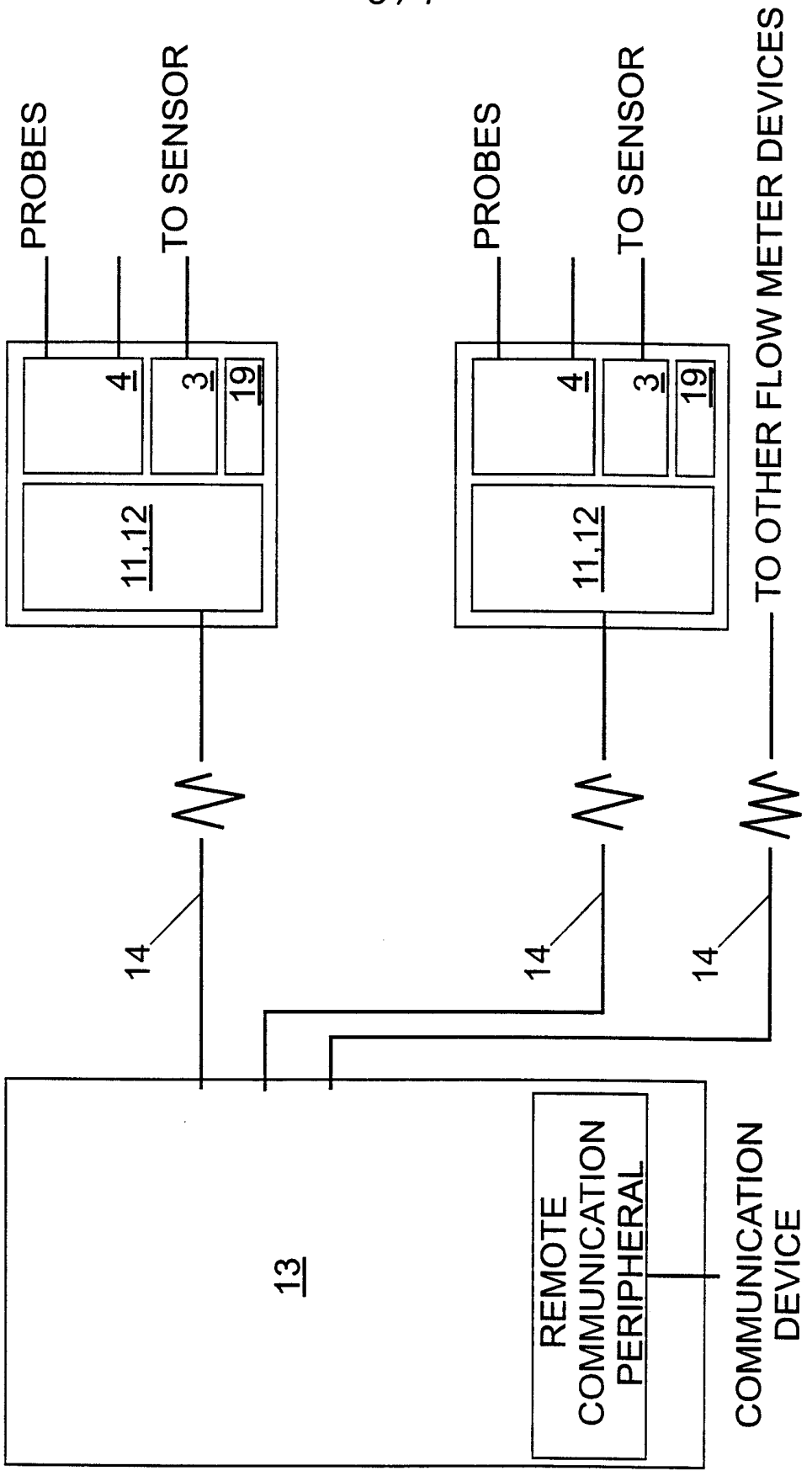


Fig. 2


PROBES
TO SENSOR
4
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PROBES
TO SENSOR
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TO OTHER FLOW METER DEVICES
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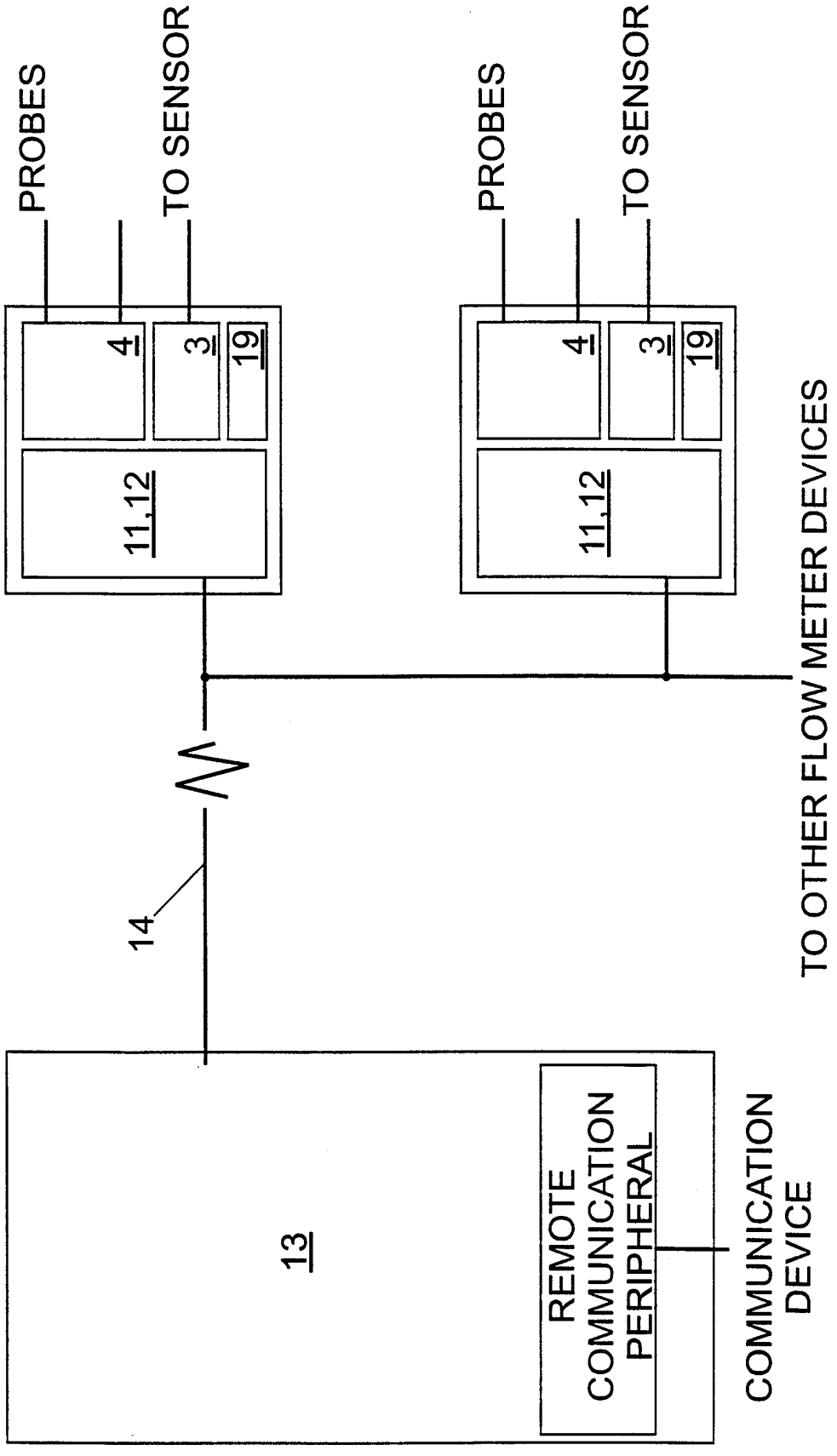
13
REMOTE COMMUNICATION PERIPHERAL
COMMUNICATION DEVICE

Fig. 3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TO OTHER FLOW METER DEVICES
14
13
REMOTE COMMUNICATION PERIPHERAL
COMMUNICATION DEVICE

Fig. 4

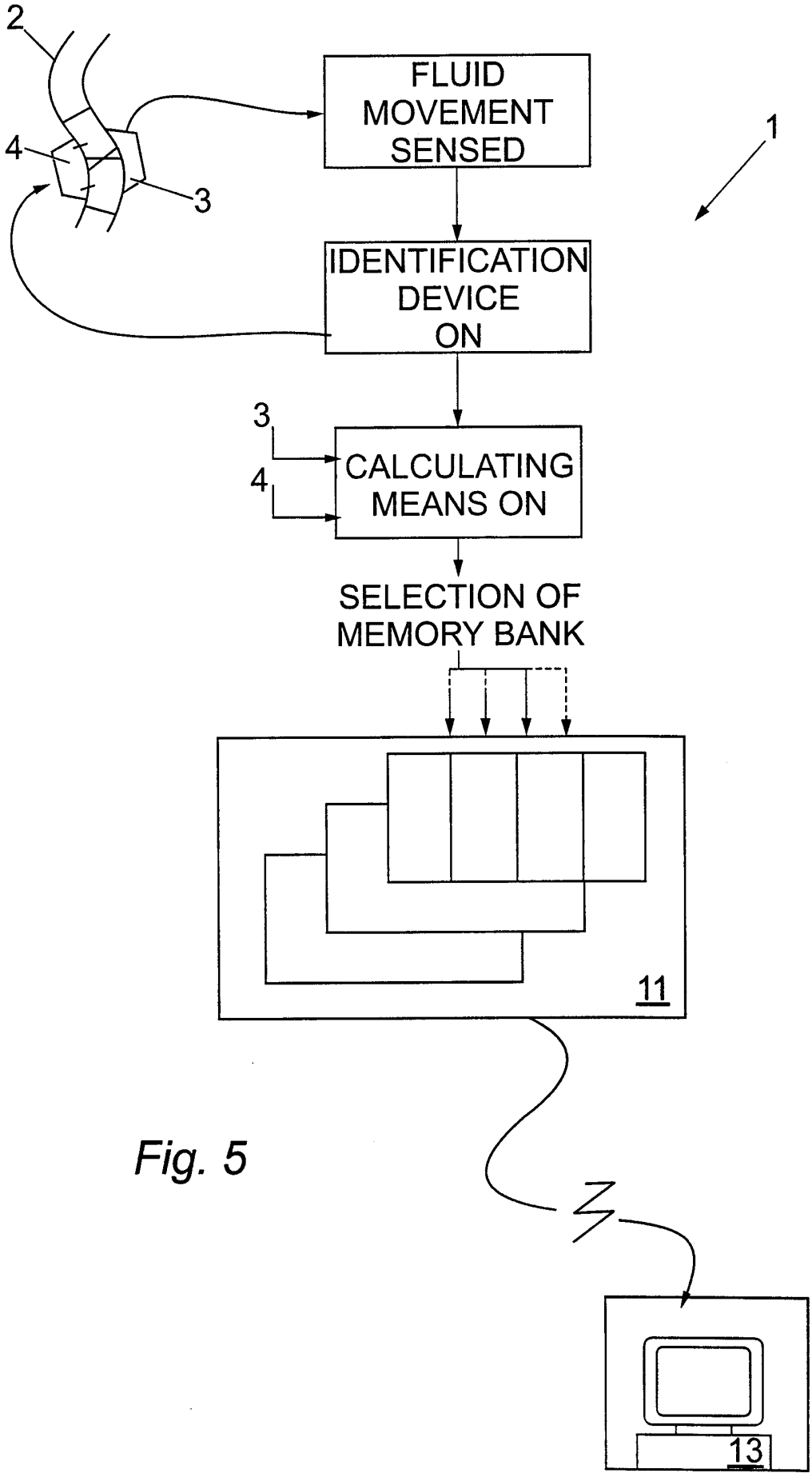
2
4
3
FLUID MOVEMENT SENSED
1
IDENTIFICATION DEVICE ON
3
4
CALCULATING MEANS ON
SELECTION OF MEMORY BANK
11
13

Fig. 5

VOLUME AUDIT REPORT

SITE ANGEL
ANGEL
STRATFORD
FROM 13/09/1998
TO 19/09/1998

7 DAYS WERE AUDITED
7 WERE FOUND

FONT LOCATION	PUMP No.	PRODUCT	PINTS	GALLONS	BARRELS	£ VALUE
BAR	1	TOBY BIT	21.50	2.69	0.07	£0.00
C.ROOM	2	TOBY BIT	0.00	0.00	0.00	£0.00
BAR	3	TOBY BIT	3.00	0.37	0.01	£0.00
BAR	4	GUINNESS	26.00	3.25	0.09	£0.00
BAR	5	CAFFREYS	5.50	0.69	0.02	£0.00
BAR	6	CARL. BLACK	0.00	0.00	0.00	£0.00
BAR	7	CARL. BLACK	86.00	10.75	0.30	£0.00
BAR	8	FOSTERS	2.50	0.31	0.01	£0.00
BAR	9	GUINNESS	3.00	0.37	0.01	£0.00
C.ROOM	10	FOSTERS	0.00	0.00	0.00	£0.00
BAR	11	TOBY BIT	23.50	2.94	0.08	£0.00
BAR	12	CARL. BLACK	5.50	0.69	0.02	£0.00
BAR	13	TENN. EXTRA	2.00	0.25	0.01	£0.00
BAR	14	FOSTERS	174.00	21.74	0.60	£0.00
BAR	15	CARL. BLACK	36.50	4.56	0.13	£0.00
BAR	16	STRONGBOW	5.50	0.69	0.02	£0.00
C.ROOM	17	WORTHI CRM	4.00	0.50	0.01	£0.00
C.ROOM	18	WORTHI CRM	4.50	0.56	0.02	£0.00
BAR	19	GROLSCH	15.00	1.87	0.05	£0.00
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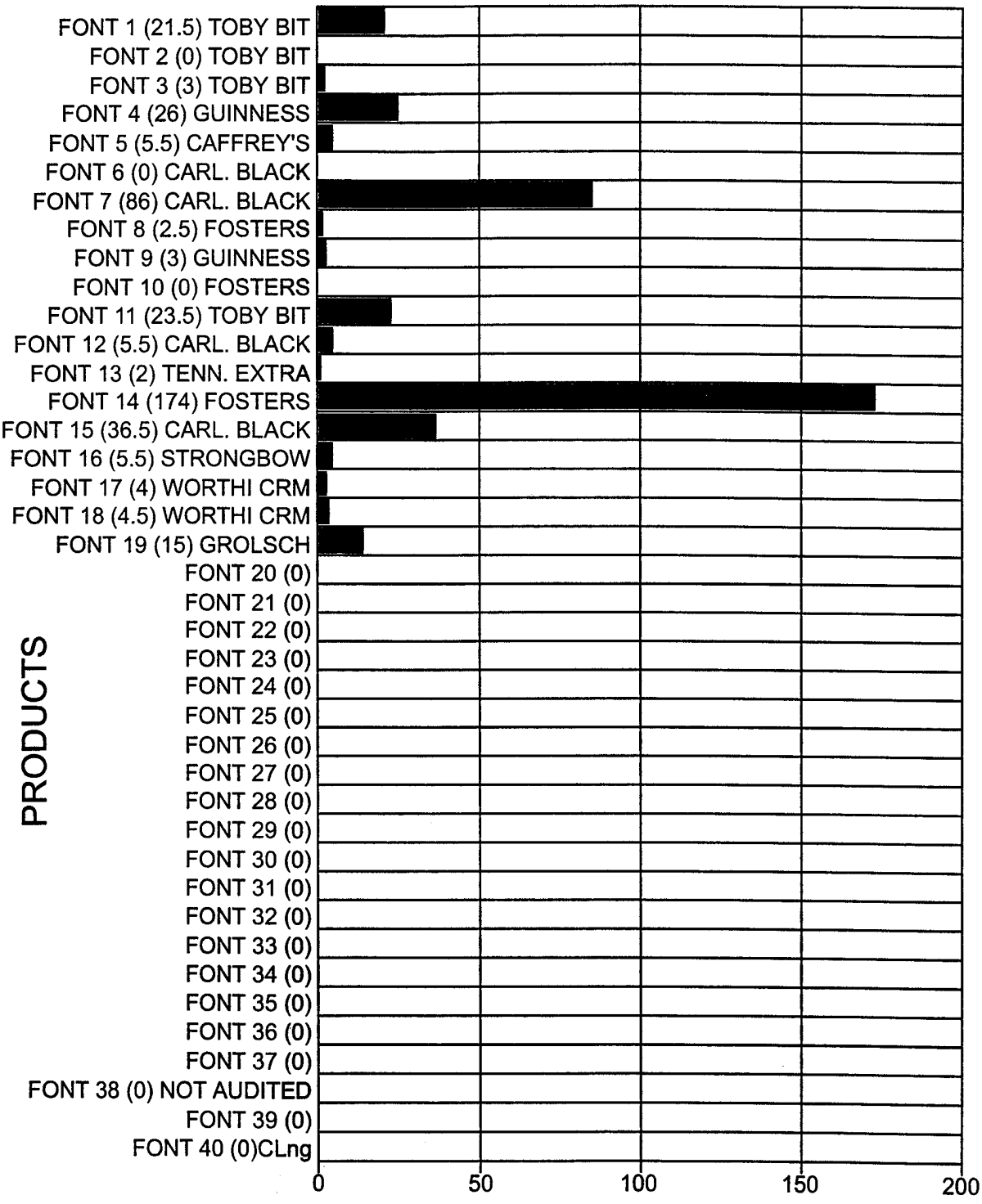
	22		0.00	0.00	0.00	£0.00
	23		0.00	0.00	0.00	£0.00
	24		0.00	0.00	0.00	£0.00
	25		0.00	0.00	0.00	£0.00
	26		0.00	0.00	0.00	£0.00
	27		0.00	0.00	0.00	£0.00
	28		0.00	0.00	0.00	£0.00
	29		0.00	0.00	0.00	£0.00
	30		0.00	0.00	0.00	£0.00
	31		0.00	0.00	0.00	£0.00
	32		0.00	0.00	0.00	£0.00
	33		0.00	0.00	0.00	£0.00
	34		0.00	0.00	0.00	£0.00
	35		0.00	0.00	0.00	£0.00
	36		0.00	0.00	0.00	£0.00
	37		0.00	0.00	0.00	£0.00
(NONE)	38	NOT AUDITED	0.00	0.00	0.00	£0.00
	39		0.00	0.00	0.00	£0.00
L Clng	40	WATER	0.00	0.00	0.00	£0.00
		TOTALS	418.00	52.23	1.45	£0.00

DATE PRINTED: 21-10-1998


FONT 1 (21.5) TOBY BIT
FONT 2 (0) TOBY BIT
FONT 3 (3) TOBY BIT
FONT 4 (26) GUINNESS
FONT 5 (5.5) CAFFREY'S
FONT 6 (0) CARL. BLACK
FONT 7 (86) CARL. BLACK
FONT 8 (2.5) FOSTERS
FONT 9 (3) GUINNESS
FONT 10 (0) FOSTERS
FONT 11 (23.5) TOBY BIT
FONT 12 (5.5) CARL. BLACK
FONT 13 (2) TENN. EXTRA
FONT 14 (174) FOSTERS
FONT 15 (36.5) CARL. BLACK
FONT 16 (5.5) STRONGBOW
FONT 17 (4) WORTHI CRM
FONT 18 (4.5) WORTHI CRM
FONT 19 (15) GROLSCH
FONT 20 (0)
FONT 21 (0)
FONT 22 (0)
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FONT 33 (0)
FONT 34 (0)
FONT 35 (0)
FONT 36 (0)
FONT 37 (0)
FONT 38 (0) NOT AUDITED
FONT 39 (0)
FONT 40 (0)CLng
PRODUCTS
0
50
100
150
200
VOLUMES (PINTS) FOR ANGEL

Fig. 7

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 99/03367

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01F15/06 G01F15/075

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 841 546 A (SAAR DAVID A) 13 May 1998 (1998-05-13) column 2 -column 6; figures 1,3	1-4, 7-10,13, 19-22
Y		5
Y	US 5 515 295 A (WANG TAK K) 7 May 1996 (1996-05-07) abstract; figures 1,3	5
A	EP 0 123 744 A (EXXON RESEARCH ENGINEERING CO) 7 November 1984 (1984-11-07) abstract; figure 1	1
A	GB 2 084 546 A (PEKTRON LTD) 15 April 1982 (1982-04-15) abstract; figure 3	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 December 1999	14/01/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Vorropoulos, G

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte: ›nal Application No
PCT/GB 99/03367

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